INDOOR AIR QUALITY REASSESSMENT

Massachusetts Department of Education
17 Pleasant Street
Malden, Massachusetts

Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health Assessment
August, 2001

Background/Introduction

In response to a request from Ron Minervini, Massachusetts Department of Education (MDOE), an indoor air quality assessment was done at the MDOE offices at 17 Pleasant Street, Malden, Massachusetts. This assessment was conducted by the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health Assessment (BEHA). The request was prompted by reports of unidentified odors that were permeating the MDOE building, particularly in the 1st floor elevator foyer.

On March 27, 2001, a visit was made to this building by Michael Feeney, Chief of Emergency Response/Indoor Air Quality (ER/IAQ), BEHA. Mr. Feeney was accompanied by Joseph Bithell, MDOE and Mr. Minervini at various times during the assessments.

Upon arrival at the building, Mr. Feeney detected a strong odor in the foyer and stairwell, as well as emanating from several storm drains along the curb in front of 17 Pleasant Street. Mr. Feeney recommended that the Malden Fire Department be contacted in case the odor was a result of a chemical spill in the storm drain system. Malden Fire Department arrived on-scene and determined that the site did not pose a fire hazard. Mr. Feeney returned to the building on March 28 and April 10, 2001 to conduct air sampling. The purpose of the April 10, 2001 visit was to conduct air monitoring to ascertain whether remediation measures had reduced TVOC levels and odors throughout the building. Mr. Feeney was accompanied by Chris Webb, Malden Board of Health at various times on these visits. Mr. Feeney accompanied Mr. Webb on a tour of the openings on the culvert that passes beneath the 17 Pleasant Street Building on April 13, 2001. This report is a summary of air testing conducted on-site within the 17 Pleasant Street building as well as the examination of the Malden culvert, beyond those

recommendations provided to MDOE staff in previous correspondence (MDPH, 2001a; MDPH, 2001b)(see Appendices A and B).

The building is a four-story structure originally built as a theater in downtown Malden, constructed prior to 1900. Prior to occupancy by the MDOE, the interior of the building was renovated. An elevator shaft was installed, which services the 1st through 4th floors of the building. MDOE staff occupy the 2nd, 3rd and 4th floors of the building. A front and back stairwell connects the upper floors to a hallway on the first floor. A door in the hallway serves as an entrance to the basement, which contains the elevator machine room. Windows in the building are openable.

MDOE staff reported periodic odors in the building that were associated with heavy rain. On March 23, 2001, a large winter rainstorm soaked New England with a 3-inch water accumulation. Shortly after this downpour, building occupants reported the presence of strong odors in the foyer and hallways.

Concurrent to the BEHA/Malden Board of Health investigation, a consultant hired by the landlord conducted air sampling within the building and concluded that "the samples have a typical petroleum product footprint" (CEA, Inc., 2001). These results can indicate that the materials creating the odor can be related to fuel oil, asphalt or other petroleum derived products.

Methods

Air tests for carbon dioxide, temperature, relative humidity and carbon monoxide were taken with the TSI, Q-Trak ™, IAQ Monitor Model 8551. Screening for total volatile organic compounds (TVOCs) was conducted using an HNu Systems, Photo Ionization Detector (PID). Outdoor background TVOC, carbon dioxide, carbon

monoxide, temperature and relative humidity measurements were taken for comparison to indoor levels.

Results

These offices have an employee population of approximately 40. Test results appear in Tables 1-6. Air samples are listed in the tables by floor and number designated on the floor plan. Each sample is given the number of the workstation closest to the location where each air sample was taken.

Discussion

Ventilation

It can be seen from the tables that the carbon dioxide levels were elevated above 800 parts per million (ppm) in seventeen of twenty-five areas sampled (see Tables), indicating problems with the ventilation system. Fresh air is supplied by ceiling mounted fresh air diffusers. Exhaust ventilation is provided by wall mounted exhaust grilles located at central points in the floor. Subsequent investigation of rooftop air handling units (AHUs) by Mr. Webb found that fresh air intakes were minimized, which limited fresh air distribution into occupied space. Mr. Webb reported that these louvers were opened in an effort to increase dilution of odors.

In order to have proper ventilation with a mechanical supply and exhaust system, the systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air. The date of the last servicing and balancing of these systems was not available at the time of the assessment. It is recommended that existing

ventilation systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994).

The Massachusetts Building Code requires a minimum ventilation rate of 20 cubic feet per minute (cfm) per occupant of fresh outside air or have openable windows in each room (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week based on a time weighted average (OSHA, 1997).

The Department of Public Health uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches.

Temperature readings recorded during the assessment ranged from 69 ^{o} F to 76 ^{o} F, which were largely within the BEHA's recommended comfort range (see Tables). The BEHA recommends that indoor air temperatures be maintained in a range of 70 ^{o} F to 78 ^{o} F in order to provide for the comfort of building occupants. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply.

Relative humidity measurements ranged from 18 to 30 percent, which were below the BEHA comfort guidelines in all areas surveyed. The BEHA recommends that indoor air relative humidity is comfortable in a range of 40 to 60 percent. The sensation of dryness and irritation is common in a low relative humidity environment. Humidity is more difficult to control during the winter heating season. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

Other Concerns

As previously mentioned BEHA's findings and recommendations regarding the reported odors are well detailed in previous BEHA correspondence (see Appendices A & B). Air monitoring results for TVOCs on March 27, 2001 were roughly double that of outdoor background concentrations (0.3 ppm) with the highest reading measured in the elevator foyer (0.8 ppm). Odors were detected in various sections of the building by BEHA staff, primarily around stairwell doors and the elevator (see Tables). TVOC measurements confirmed the presence of volatile organic compounds in the indoor environment, which were traced to a sealed opening in the east wall of the basement adjacent to the elevator shaft (see Picture 1). The plug on this opening was removed to

reveal the presence of a drainage culvert that shares the east wall of the building foundation (see Picture 2). Additional plugs, consisting of a gypsum wallboard (GW) type material, sealed similar openings into the culvert along the east basement wall (see Picture 3) on the opposite side of the elevator shaft. Installation of the elevator shaft removed the original ceiling of the culvert, which was replaced with corrugated steel decking (see Picture 4). Measurements of 1 ppm of TVOCs inside the culvert indicated that the source of odors was most likely inside the culvert. It should be noted that TVOCs have a relatively low odor threshold and for that reason their presence can frequently be detected below levels of health concern.

Subsequent remediation efforts to reduce/remove odors were effective. BEHA staff did not detect odors in the occupied areas of the DOE offices during the April 10, 2001 visit. Slight odors were noted in the elevator shaft. Indoor TVOC concentrations measured inside the building were equivalent to outdoor concentrations (see Tables), indicating that either remediation efforts to reduce depressurization of stairwells and operating the HVAC system reduced or eliminated odors from occupied areas or that the conditions within the culvert have changed to cause the source of the odors to dissipate.

On April 13, 2001, Mr. Feeney and Mr. Webb conducted an investigation of the openings to the Malden culvert as well as storm drains that run its length (see Map 1). The Malden culvert directs water underground through an opening adjacent to the Forest Hills MBTA Orange Line Subway stop. Water is directed by a concrete lined streambed (see Picture 5), which enters into the culvert through flood control gates upstream (see Picture 6). While some sheen of an unknown product (see Picture 7) was noted in the flood control channel, no odors similar to that noted within 17 Pleasant Street were noted at this point or other storm drains upstream. The newly installed vent beneath the 17

Pleasant Street loading dock and storm drains on both sides of Pleasant Street were free of the odor, unlike previous visits. The culvert water empties into the Malden River from a flood control gate in an area bounded by Centre, Canal, Commercial and Charles Streets (Map 2). No sheen of product or odors similar to that noted within 17 Pleasant Street were noted at this point or other storm drains upstream either.

An odor was detected in a culvert by Mr. Feeney and Mr. Webb emanating from a storm drain within the parking lot of the former Mal's Supermarket, in an area bounded by Centre, Exchange and Jackson Streets (see Map 3). Another storm drain (most immediate to the parking lot storm drain mentioned above) located in an alley behind a dry cleaners (see Map 3) building was found free of the odor. Therefore, it appears the most likely source of the material creating the odor is from the culvert in the area bounded by Centre, Exchange and Jackson Streets.

The means for how this odor is moving, from its location by the Centre, Exchange and Jackson Streets area to a point two blocks upstream, is due to the location of the south culvert entrance, the size change in diameter of the culvert and the location of the culvert chamber below 17 Malden Street. The Malden River opening of the culvert faces south. Its configuration makes the culvert vulnerable to pressurization in a south, southwesterly wind. The culverts act as an air scoop, directing wind into the culvert interior. Malden Water and Sewer Department personnel report that the diameter of the culvert alternates in size along its course. The south opening in the culvert is an estimated twenty feet in height. The culvert reduces to a three foot diameter until it reaches the chamber beneath 17 Pleasant Street, where it expands to ~15 feet in height and ~30 feet in width. The width of the culvert again decreases in diameter to 3 feet. The configuration of the culvert chamber below 17 Pleasant Street serves as an air baffle

that slows the airflow. If airborne contaminants in the upwind section of the pipe are entrained, the airflow carries these contaminants into the chamber where the slowing of airflow and structure of the culvert chamber can create pooling of these materials (see Figure 1). The culvert chamber becomes pressurized by: 1) airflow into the chamber downstream and 2) water filling the culvert upstream, creates an air pocket and forces air back into the chamber. With the chamber pressurized, accumulated air and airborne contaminants will be forced from the chamber through cracks, crevices, spaces around plug/doors, and other openings that exist in the culvert chamber's walls, floor and ceiling.

Conclusions/Recommendations

Over the course of this evaluation, airborne contaminant levels decreased as demonstrated by the air monitoring and confirmed subjectively by BEHA staff who assessed odors. Measures taken to decrease odors in the building may have corrected this odor problem, or the source of materials creating the odor has settled, dried out or dissipated. The conditions creating the pathway for odors (e.g., excessively heavy rainfall combined with a south/southwest wind) may have ceased or altered to prevent a reoccurrence of the odor problem. It is likely that unless the point source creating the odors is identified and remediated, similar weather that produced the conditions resulting in the odor penetrating into 17 Pleasant Street are likely to reoccur. In view of the findings at the time of this visit, the following conclusions and recommendations are made:

1. Implement the recommendations in the previous recommendations enumerated in previous correspondence (see Appendices A and B).

2. The downstream source of the odors should be identified and remediated by the appropriate environmental agencies to prevent a reoccurrence of this problem.

References

BOCA. 1993. The BOCA National Mechanical Code/1993. 8th ed. Building Officials & Code Administrators International, Inc., Country Club Hills, IL.

CEA, Inc. 2001. Letter to Michael Jaffe, Eastport Real Estate Services from Michael Gere and Thomas Cronin, CEA, Inc. concerning Covino Project 01.00455 Air Monitoring Results Massachusetts Department of Education, 17 Pleasant Street, Malden, Massachusetts, dated April 4, 2001. Covino Environmental Associates, Inc., Woburn, MA.

MDPH. 2001a. Letter to Ron Minervini, Director of Operations, MA Department of Education from Suzanne Condon, Director, Bureau of Environmental Health Assessment concerning odors at the Dept. of Education Offices, 17 Pleasant Street, Malden, MA, dated March 29, 2001. Massachusetts Department of Public Health, Bureau of Environmental Health Assessment, Boston, MA.

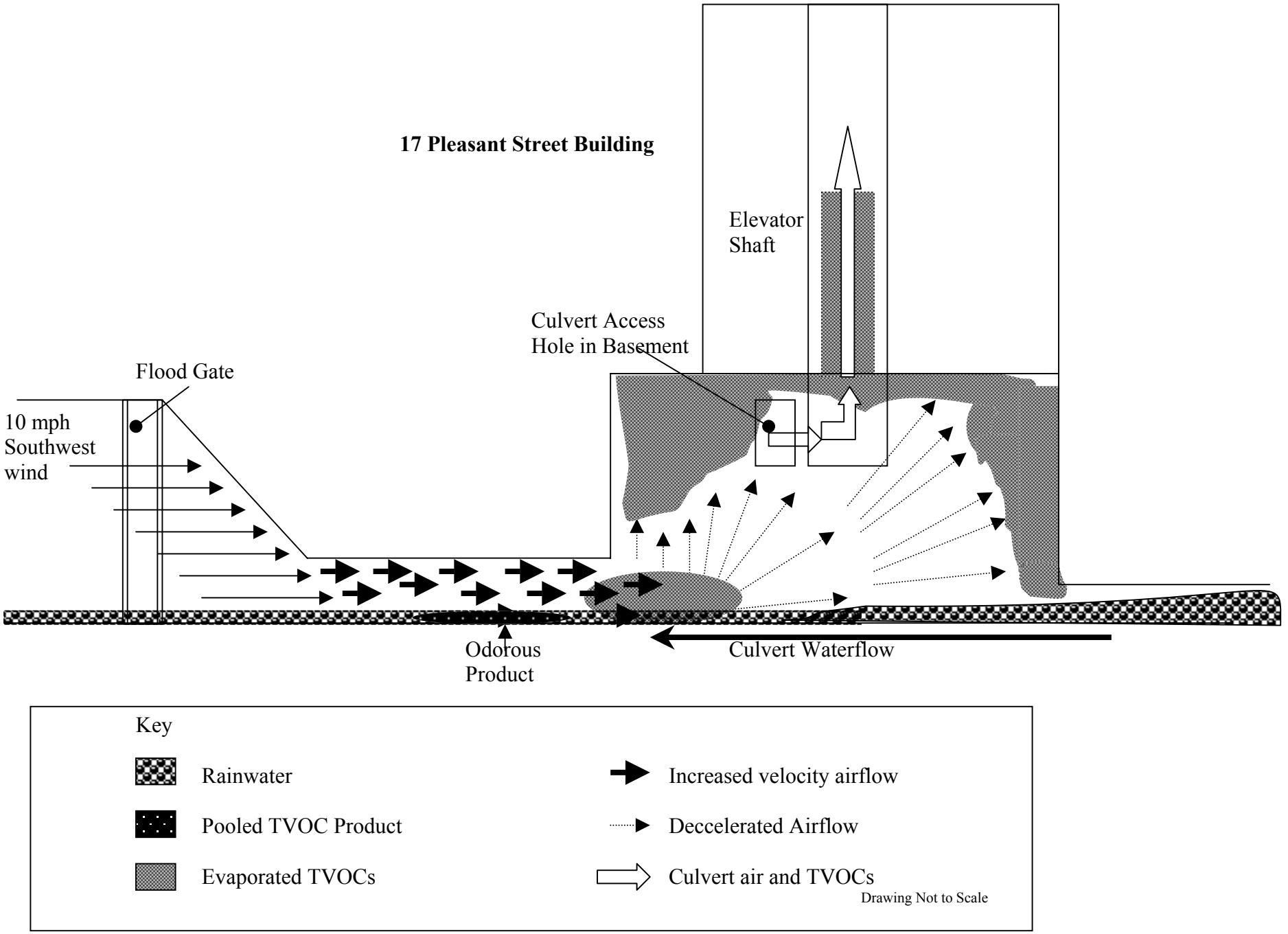
MDPH. 2001b. Letter to Ron Minervini, Director of Operations, MA Department of Education from Suzanne Condon, Director, Bureau of Environmental Health Assessment concerning odors at the Dept. of Education Offices, 17 Pleasant Street, Malden, MA, dated April 12, 2001. Massachusetts Department of Public Health, Bureau of Environmental Health Assessment, Boston, MA.

OSHA. 1997. Limits for Air Contaminants. Occupational Safety and Health Administration. Code of Federal Regulations. 29 C.F.R. 1910.1000 Table Z-1-A.

SBBRS. 1997. Mechanical Ventilation. State Board of Building Regulations and Standards. Code of Massachusetts Regulations. 780 CMR 1209.0

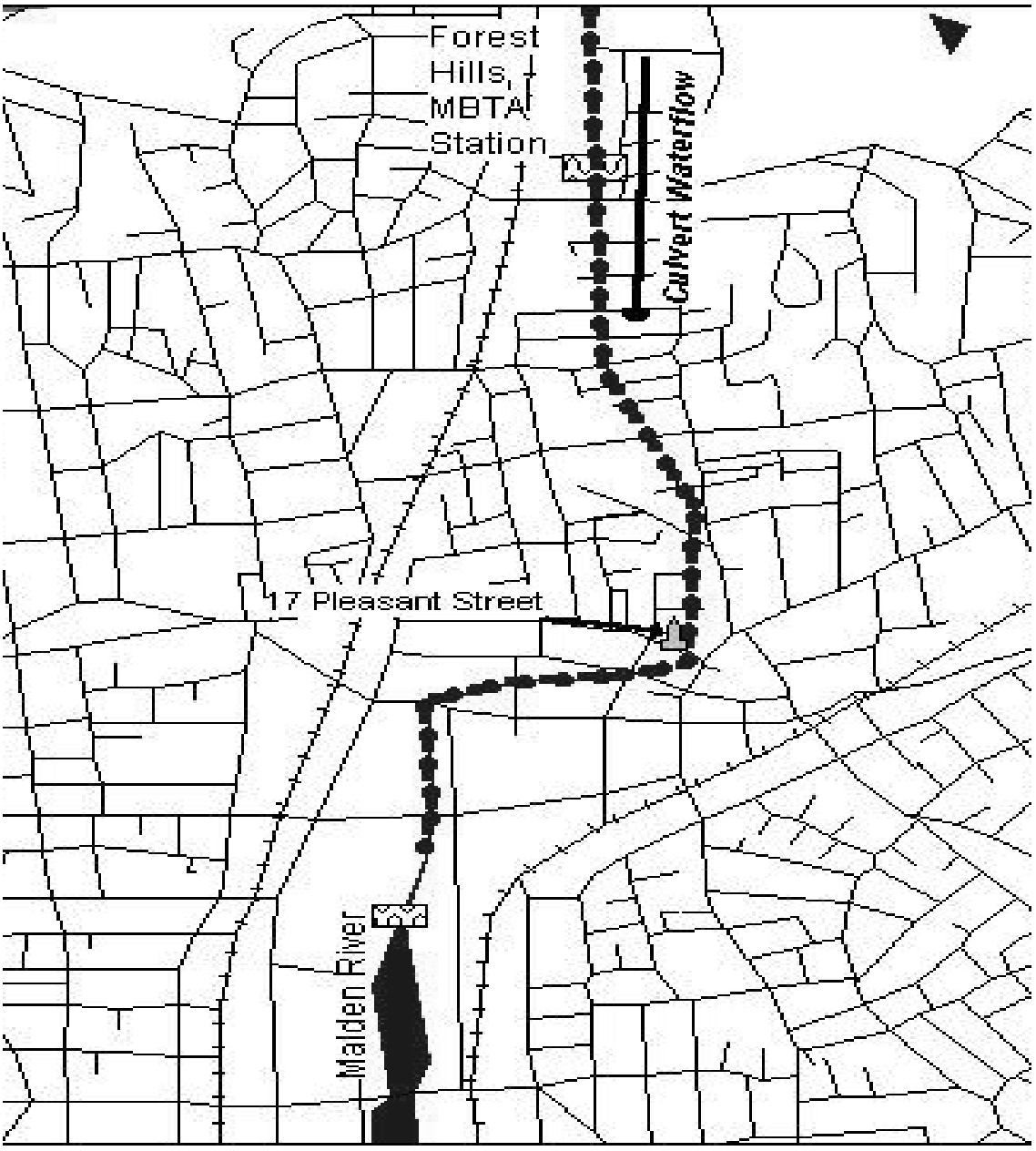
SMACNA. 1994. HVAC Systems Commissioning Manual. 1st ed. Sheet Metal and Air Conditioning Contractors' National Association, Inc., Chantilly, VA.

Figure 1 **Pressurization of Culvert Chamber Forcing Odors into 17 Pleasant Street**



Map1

The General Course of the Malden Culvert from Forest Hill MBTA Station to the Malden River



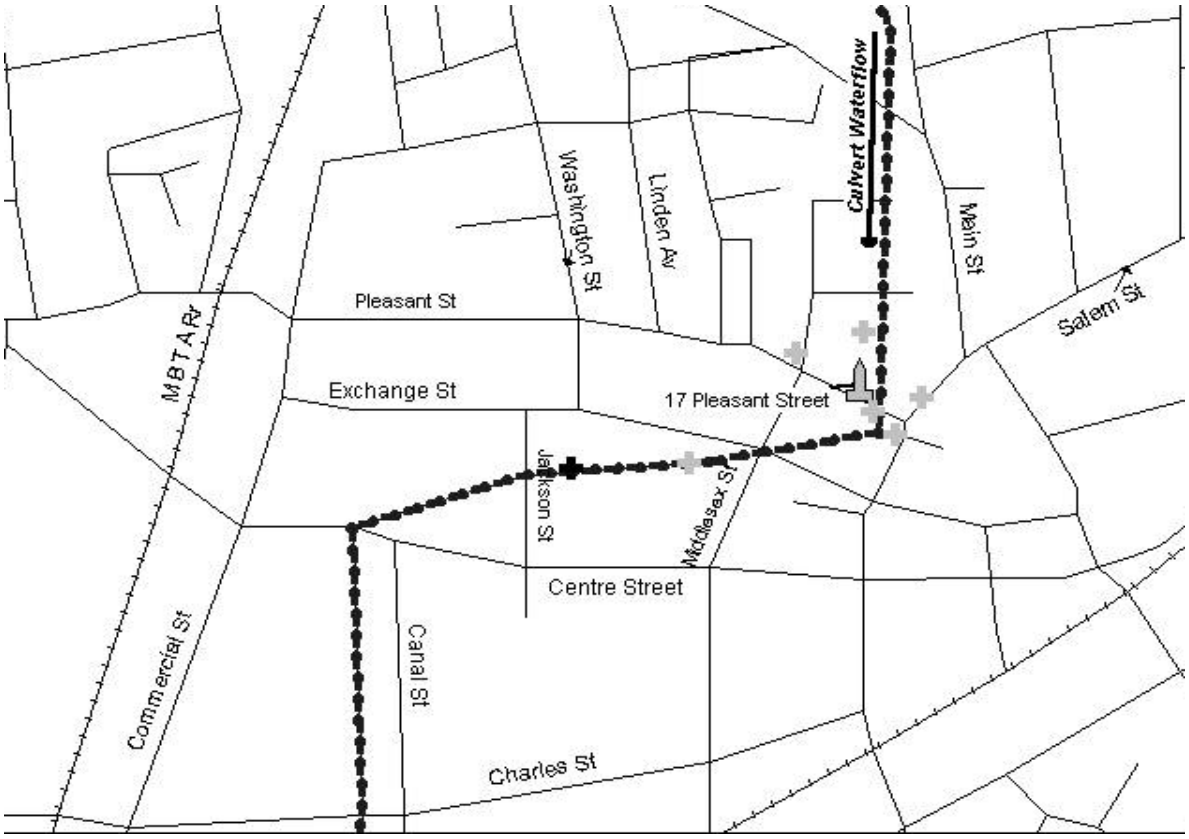
Key

Dotted Line = Estimated Course Of Culvert
Wavy-Lined Blocks = General Location Of
Underground Entrances and Exits for Culvert

Drawing Is Estimated And Not To Scale

Map 2

The General Course of the Malden Culvert and Location of Storm Drains Examined



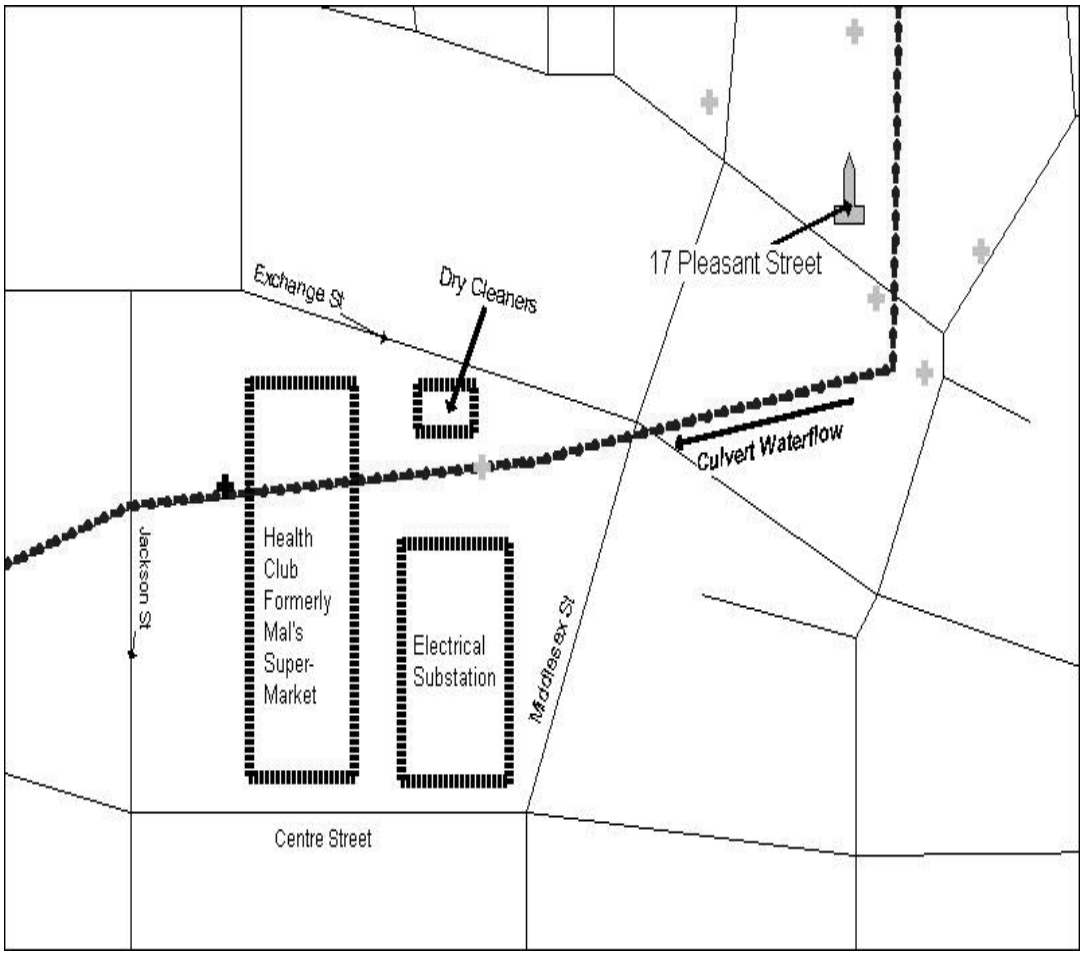
Key

Dotted Line = Represents Estimated Course Of Culvert
Grey Cross = Storm Drain With No Odor
Black Cross = Odor Detected Emanating From Culvert

Drawing Is Estimated And Not To Scale

Map 3

General Vicinity of Storm Drains and Building Bound by Exchange, Jackson and Centre Streets



Key

Dotted Line = Estimated Course Of Culvert
Grey Cross = Storm Drain With No Odor
Black Cross = Odor Detected Emanating From Culvert

Drawing Is Estimated And Not To Scale

Picture 1

Sealed Opening in the Basement East Wall Adjacent to the Elevator Shaft

Picture 2

Holes In East Wall Sealed with Wallboard

Picture 3

Drainage Culvert That Shares the East Wall of the Building Foundation

Picture 4

Original Culvert Ceiling Replaced With Corrugated Steel Decking

Picture 5

Concrete Lined Streambed

Picture 6

Culvert through Flood Control Gates Upstream Opening Near Forest Hills MBTA Station

Picture 7

Sheen of an Unknown Product in the Forest Hills Flood Control Channel

TABLE 1

Indoor Air Test Results – Massachusetts Department of Education, 17 Pleasant Street, Malden, MA March 27, 2001

Remarks	Carbon Dioxide *ppm	TVOC	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
							Intake	Exhaust	
Outside (Background)	485	0.3	59	29					
4th Floor									
Cafeteria	1016	0.6	73	24	2	Yes	Yes	No	**LEL = 3
Roger Hatan Office	958	0.6	73	24	1	Yes	Yes	No	LEL = 0, door open
Wulfsen	919	0.6	73	23	0	Yes	Yes	No	LEL = 0, door open
Hallway East	921	0.6	73	29	1	No	Yes	No	LEL = 3, 1 ajar CT
Elevator Work Area	924	0.6	73	23	0	No	Yes	No	LEL = 3, odor at door
Front Stairway Door	958	0.7	74	26	0	No	Yes	No	LEL = 3, odor at door, gaps around door
Back Stairway Door	940	0.6	74	24	0	No	Yes	No	LEL = 3, odor
West Center Hall Work Area	906	0.6	76	21	3	No	Yes	No	LEL = 3, 1 ajar CT

*** ppm = parts per million parts of air**
CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 2

Indoor Air Test Results – Massachusetts Department of Education, 17 Pleasant Street, Malden, MA March 27, 2001

Remarks	Carbon Dioxide *ppm	TVOC	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
							Intake	Exhaust	
West Hall	931	0.5	76	20	4	No	Yes	No	LEL = 3
3rd Floor									
Conference Room	661	0.5	70	18	0	Yes	Yes	No	Window and door open, supply off
East Work Area	657	0.5	69	19	0	No	Yes	No	Supply off
Elevator	650	0.7	69	30	0	No	Yes	No	Supply off, odor
Hallway – Front Stairwell	672	0.7	69	25	0	No	Yes	No	Odor
Hallway – Back Stairwell	703	0.7	71	23	0	Yes	Yes	No	Odor, door open
West Center Work Area	736	0.7	72	22	5	Yes	Yes	No	Window open
West Work Area	701	0.5	72	20	5	Yes	Yes	No	Window open
Mascheran	981		72	27	1	Yes	Yes	No	Door open

*** ppm = parts per million parts of air**
CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 3

Indoor Air Test Results – Massachusetts Department of Education, 17 Pleasant Street, Malden, MA March 27, 2001

Remarks	Carbon Dioxide *ppm	TVOC	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
							Intake	Exhaust	
2nd Floor									
Mascharen Office	981	0.6	72	27	1	Yes	Yes	No	Door open
East Work Area	1101	0.6	72	26	3	Yes	Yes	No	
Southeast Corner Office	801	0.6	73	21	0	Yes	Yes	No	Door open
Elevator	956	0.6	73	24	0	No	Yes	No	Odor
Hallway – Front Stairwell	1059	0.7	74	25	0	No	Yes	No	Odor
Hallway – Back Stairwell	1201	0.7	74	25	0	No	Yes	No	Odor
West Center Area	1201	0.7	74	26	5	Yes	Yes	No	
West Work Area	1227	0.7	75	24	3	Yes	Yes	No	
1st Floor Elevator Foyer	652	1.0	72	33	0		No	No	

*** ppm = parts per million parts of air**
CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 4

Indoor Air Test Results – Massachusetts Department of Education, 17 Pleasant Street, Malden, MA
April 10, 2001

Remarks	Carbon Dioxide *ppm	TVOC	Temp. °F	Relative Humidity %	Remarks
Outside (Background)	485	0.6	59	29	
4th Floor					
Northeast Corner		0.6			
Front Stairwell – Hallway		0.6			
Front Stairwell – Landing		0.6			
Back Stairwell – Hallway		0.6			
Back Stairwell – Landing		0.6			
Northwest Hallway – near return vent		0.6			
West Hallway		0.6			
South Elevator Hallway		0.6			

*** ppm = parts per million parts of air**
CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 5

Indoor Air Test Results – Massachusetts Department of Education, 17 Pleasant Street, Malden, MA
April 10, 2001

Remarks	Carbon Dioxide *ppm	TVOC	Temp. °F	Relative Humidity %	Remarks
Elevator Center		0.6			
3rd Floor Front Stairwell Hallway		0.6			
Back Stairwell Hallway		0.6			
Northwest Hallway – under return		0.6			
West Hallway		0.6			
South Hallway – Return		0.6			
2nd Floor Front Stairwell Hallway		0.6			
Back Stairwell		0.6			
Southwest Hallway		0.6			

*** ppm = parts per million parts of air**
CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 6

Indoor Air Test Results – Massachusetts Department of Education, 17 Pleasant Street, Malden, MA
April 10, 2001

Remarks	Carbon Dioxide *ppm	TVOC	Temp. °F	Relative Humidity %	Remarks
West Hallway		0.6			
South Hallway		0.6			
Vent Back		0.6			
Basement		0.6			

*** ppm = parts per million parts of air**
CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

Appendix I

Letter Concerning
Indoor Air Quality Assessment

Massachusetts Department of Education
17 Pleasant Street
Malden, Massachusetts

March 29, 2001

The Commonwealth of Massachusetts
Executive Office of Health and Human Services
Department of Public Health
250 Washington Street, Boston, MA 02108-4619

JANE SWIFT
GOVERNOR

ROBERT P. GITTENS
SECRETARY

HOWARD K. KOH, MD, MPH
COMMISSIONER

March 29, 2001

Ron Minervini, Director of Operations
Massachusetts Department of Education
350 Main Street
Malden, MA 02148-5023

Dear Mr. Minervini:

As you know, Michael Feeney, Chief of the Emergency Response/Indoor Air Quality Program, of the Bureau of Environmental Health Assessment (BEHA) responded to your request for assistance concerning odors at the Massachusetts Department of Education (DOE) offices at 17 Pleasant Street, Malden, MA on March 27, 2001. Mr. Feeney returned on March 28, 2001 to accompany Chris Webb, Malden Board of Health, to conduct air monitoring in the building. A detectable, but unidentified odor was noted in the first floor elevator foyer on both days of this assessment. Employees reported that odors were penetrating into occupied areas on upper floors from stairwell doors. The odor was detected in stairwells and the elevator foyer.

As a result of these assessments, we concur with the Department of Education's decision to temporally relocate personnel to another location until the odor issue in the building is resolved. It is our understanding that the landlord has contracted with Covino Environmental Associates to conduct air monitoring within the building. It is also our understanding that Mr. Webb will request assistance from the Massachusetts Department of Environmental Protection (MDEP) Northeast Regional Office to conduct analysis of the culvert odor. BEHA staff will review all environmental monitoring data associated with this odor and continue to work with the Malden Board of Health, Malden Fire Department, MDEP and your staff in order to address concerns.
During this assessment, Mr. Feeney located an opening in the wall that is sealed with a plug held in place with screws in the area of the basement below the first floor foyer. This plug seals a portal that opens into a culvert system, which appears to share the east wall of the basement. The origin of the odor appears to be outside of the building, emanating from the opening into the culvert system when the plug was removed. A similar odor was noted emanating from storm drains in front of the building and beneath the loading dock. A pathway (presumably somewhere along the basement east wall or ceiling decking over the culvert) exists that allows for the odor to be drawn from the

culvert into the building's elevator shaft. Once inside the shaft, the odor is distributed to upper floors through the elevator doors.

Another pathway from the first floor for the odor to travel to the upper stories of the building are the stairwells. In order to attempt to exhaust the odor from the building, exhaust vents were installed in the ceiling of each stairwell. While providing exhaust ventilation, the existence of these vents *enhances* airflow from the first floor up the stairwell, which results in a greater delivery of odor to the upper floors.

Exacerbating the draw of odors into the occupied areas of the building are the operation of the return vents of the heating, ventilating and air-conditioning (HVAC system) and restroom exhaust vents. The operation of these vents in close proximity to the elevator shaft and stairwells can serve to draw odors into the office areas through space in and around the doorframes.

Since the source of the odor appears to be the storm drains, the following recommendations should be implemented as soon as possible in order to reduce the migration of odors into occupied.

1. Upon the recommendation of Chris Webb of the Malden Board of Health, the stairwell exhaust vent turbines on the roof were sealed with plastic bags and duct tape to reduce odor draw up the stairwells.

2. Operate the HVAC system 24 hours a day until odor resolves to provide maximum ventilation of this space.

3. Fresh airflow from the HVAC system should be increased. The HVAC system should be adjusted to place occupied office space under positive pressure to minimize the draw of air from stairwells and the elevator shaft.

4. Maximize the use of open windows in order to dilute odors from the occupied areas. Please be sure to open windows on opposite-facing walls to create cross ventilation.

5. Examine the elevator well for air pathways from the culvert. These pathways must be sealed.

6. Seal the frame of the portal with a plug that is larger than the portal frame. Affix a caulking material in a continuous application so that when the plug is placed over the wood frame, an airtight seal is created.

7. Once the plug is installed, continue to seal holes/spaces in the east wall of the basement.

8. Install weather stripping and door sweeps on all stairwell doors and the basement door to create a barrier

9. Seal all stairwell doorframes/gypsum wallboard junctions with caulking.

10. Deactivate the first floor elevator foyer heater.

A full report detailing air monitoring conducted in this building as well as further advice once additional environmental test results are available will following this letter. Please feel free to contact us at (617) 624-5757 if you are in need of further information or technical assistance.

Respectfully,

Suzanne Condon, Assistant Commissioner
Bureau of Environmental Health Assessment

cc/ Mike Feeney, Chief, Emergency Response/Indoor Air Quality
Martha Steele, Dep. Dir., BEHA
Chris Webb, Malden Board of Health
Chief Dennis LaFeniere, Malden Fire Dept.
David Driscoll, Commissioner, DOE
Jeff Wulfson, MDOE
Joseph Bithell, MDOE

Appendix II

Letter Concerning
Indoor Air Quality Assessment

Massachusetts Department of Education
17 Pleasant Street
Malden, Massachusetts

April 12, 2001

The Commonwealth of Massachusetts
Executive Office of Health and Human Services
Department of Public Health
250 Washington Street, Boston, MA 02108-4619

JANE SWIFT
GOVERNOR

WILLIAM D. O'LEARY
SECRETARY

HOWARD K. KOH, MD, MPH
COMMISSIONER

April 12, 2001

Ron Minervini, Director of Operations
Massachusetts Department of Education
350 Main Street
Malden, MA 02148-5023

Dear Mr. Minervini:

At your request, staff from the Bureau of Environmental Health Assessment (BEHA) have conducted several site visits to conduct air monitoring for the presence of volatile organic compounds at the Massachusetts Department of Education (DOE) offices at 17 Pleasant Street, Malden, MA. Most recently (April 10), Michael Feeney, Chief of the Emergency Response/Indoor Air Quality Program, BEHA conducted air monitoring and visual assessment to assess the effectiveness of measures taken to reduce/eliminate odors within this building. In previous correspondence, BEHA staff identified a culvert below the first floor of the building as the source of the odor. After identifying the source of the odor, a number of recommendations were made to eliminate odor penetration into the occupied space of the building.

The following actions have been taken by staff to reverse the air pressure relationship between the culvert and occupied space. During the assessments conducted in late March, the culvert was under positive air pressure while the occupied areas were depressurized. This air pressure relationship can result in the odors present in the culvert being drawn into occupied areas by the ventilation system and subsequently drawn up the stairwell by ceiling-mounted exhaust vents and restroom exhaust vents. Steps were recommended to reverse the pressure relationship to increase the air pressure in the building, which would serve to force air back into the culvert. Additional recommendations to create physical barriers between the culvert and occupied areas were also made. These include:

1. Upon the recommendation of Chris Webb of the Malden Board of Health, the stairwell exhaust vent turbines on the roof were sealed with plastic bags and duct tape to reduce odor draw up the stairwells.

Remedial Action: Passive exhaust vents in the ceiling of each stairwell were temporarily sealed. Since the initial assessments during the fourth week of March, fans to direct outdoor air into the stairwells were installed and were operating during the most recent assessment. The operation of these fans has reversed the air pressure in the stairwells, which in turn had forced culvert air out of the stairwells. Fresh air introduced into stairwells has also forced fresh air through the stairwell door.

2. Operate the HVAC system 24 hours a day until odor resolves to provide maximum ventilation of this space. Fresh airflow from the HVAC system should be increased. The HVAC system should be adjusted to place occupied office space under positive pressure to minimize the draw of air from stairwells and the elevator shaft.

   Remedial Action: HVAC system intakes were readjusted to increase fresh air draw into occupied areas.

3. Install weather stripping and door sweeps on all stairwell doors and the basement door to create a barrier. Seal all stairwell doorframes/gypsum wallboard junctions with caulking.

   Weather stripping and door sweeps were installed on stairwell and basement doors. While door sweeps were installed, weather-stripping was not installed in a manner to limit airflow through the door system. Mr. Minervini reported that a request to reinstall weather-stripping was made to the landlord. Some stairwell doorframes/gypsum wallboard junctions were sealed. All seams between doorframes/gypsum wallboard junction as well as doorframe seams should be sealed (see Pictures 1 and 2).

4. Deactivate the first floor elevator foyer heater.

   Remediation Action: This equipment was operating during the assessment.

5. Maximize the use of open windows in order to dilute odors from the occupied areas. Please be sure to open windows on opposite-facing walls to create cross ventilation.

   Remediation Action: Building occupants open windows as needed.

6. Examine the elevator well for air pathways from the culvert. These pathways must be sealed.

   Remediation Action: As reported by DOE personnel, no visible odor pathways were visually identified between the culvert wall and elevator shaft.

In addition to BEHA recommendations, a hole was also cut in the wall beneath the loading dock in an effort to provide odor ventilation/air pressure relief within the culvert (see Picture 3). After the implementation of these recommendations, BEHA staff could not detect culvert odors in

the office areas, basement nor in an unoccupied barbershop. Air monitoring for total volatile organic compounds (TVOCs) measured in the office areas, basement and the unoccupied barbershop were equal to levels measured outdoors [0.6 parts per million (ppm)]. Previous TVOC air measurements (March 28, 2001) were twice the outdoor levels measured (outdoors 0.4 ppm; 0.8 ppm in office space and 1.2 ppm at the culvert access door). The equalization of TVOC indoor levels to outdoor levels indicates the reconfiguration of the ventilation system has reduced the concentration/eliminated the source of odor into office space. The combination of these air measurements and lack of detectable odors in the building indicates that either the measures taken were effective or the source odors from the culvert have been reduced dramatically or eliminated.

During the course of the April 10th assessment, Mr. Feeney was provided access to the barbershop that shares an interior wall with the first floor elevator lobby of 17 Pleasant Street. It appears that the renovation of this building resulted in the installation of a stairwell post that penetrates through the original flooring (see Picture 4). There appears to be several layers of floor in this wall space. Air movement was noted around the stairwell support post, which may indicate another odor pathway from the culvert (see Figure 1). If any space exists between the layer of flooring culvert odors may be drawn into the elevator shaft through spaces around the first floor elevator door faceplate.

Please note that the source of the culvert odors has not been identified. Since the source is still not known, increased concentrations of materials causing the odor may result in increased reports of odors through unidentified pathways in 17 Pleasant Street despite remediation efforts if a heavy volume of rainwater enters the culvert.

Mr. Minervini reported that the landlord is planning to install an airtight membrane to block odors moving from the culvert into occupied areas. This installation may involve the application of mastics, glues or other materials that can contain volatile organic compounds that can be an odor source in the building during installation. We recommend that the following precautions be taken until this membrane system is completely installed to minimize or eliminate culvert odor or membrane installation pollutants from penetrating into the office space.

1. If possible, relocate susceptible persons and those with pre-existing medical conditions (e.g., hypersensitivity, asthma) away from areas of renovations.

2. Develop a notification system for building occupants to report the return of odors to the building administrator. Have these concerns relayed to the contractor in a manner to allow for a timely remediation of the problem.

3. Open windows to provide cross ventilation if the odor returns on office floors.

4. During the installation of the membrane by the landlord, schedule this project which produce large amounts of dusts, odors and emissions during unoccupied periods or periods of low occupancy, preferably over a weekend.

5. Disseminate scheduling of the membrane installation itinerary to all affected parties, this can be done in the form of meetings, newsletters or weekly bulletins.

6. Obtain Material Safety Data Sheets (MSDS) for all construction materials used during membrane installation and keep them in an area that is accessible to all individuals during periods of building operations as required by the Massachusetts Right-To-Know Act (MGL, 1983). Copies of MSDS's and product specifications should be forwarded to BEHA staff for review.

7. Consult MSDS' for any material applied to the effected area during membrane installation. Provide proper ventilation and allow sufficient curing time as per the manufacturer's instructions concerning these materials.

8. Use local exhaust ventilation and isolation techniques to control for membrane installation pollutants. Precautions should be taken to avoid the re-entrainment of these materials into the building's HVAC system. The design of each system must be assessed to determine how it may be impacted by renovation activities. Specific HVAC protection requirements pertain to the return, central filtration and supply components of the ventilation system. This may entail shutting down systems (when possible) during periods of heavy construction and demolition, ensuring systems are isolated from contaminated environments, sealing ventilation openings with plastic and utilizing filters with a higher dust spot efficiency where needed (SMACNA, 1995).

9. Seal hallway doors with construction barriers with polyethylene plastic and duct tape to create a secondary barrier to prevent migration of renovation generated pollutants into occupied areas.

10. Implement prudent housekeeping and work site practices to minimize exposure to renovation pollutants. This may include constructing barriers, sealing off areas, and temporarily relocating furniture and supplies. To control for dusts, a high efficiency particulate air filter (HEPA) equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended.

11. Continue working with the landlord and consultants to monitor indoor air quality.

We believe that if the following precautions are implemented, DOE staff may reoccupy the building. A full report detailing all air monitoring conducted in this building is expected to follow in the next several weeks. Please feel free to contact us at (617) 624-5757 if you are in need of further information or technical assistance.

Respectfully,

Suzanne Condon, Assistant Commissioner
Bureau of Environmental Health Assessment

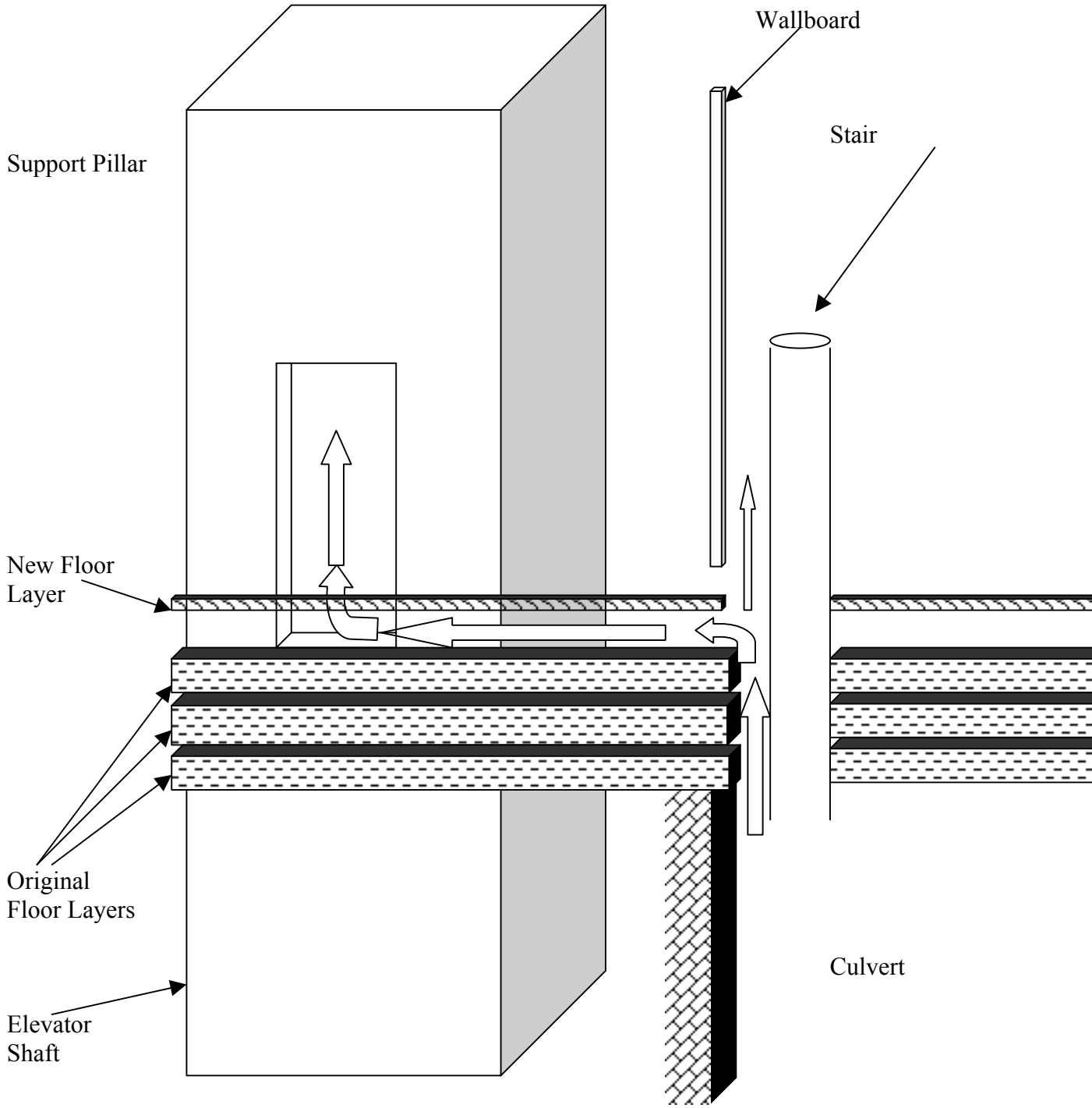
cc/ Mike Feeney, Chief, Emergency Response/Indoor Air Quality
Martha Steele, Dep. Dir., BEHA
Chris Webb, Malden Board of Health
Chief Dennis LaFeniere, Malden Fire Dept.
David Driscoll, Commissioner, DOE
Jeff Wulfsen, DOE
Joseph Bithell, DOE

References

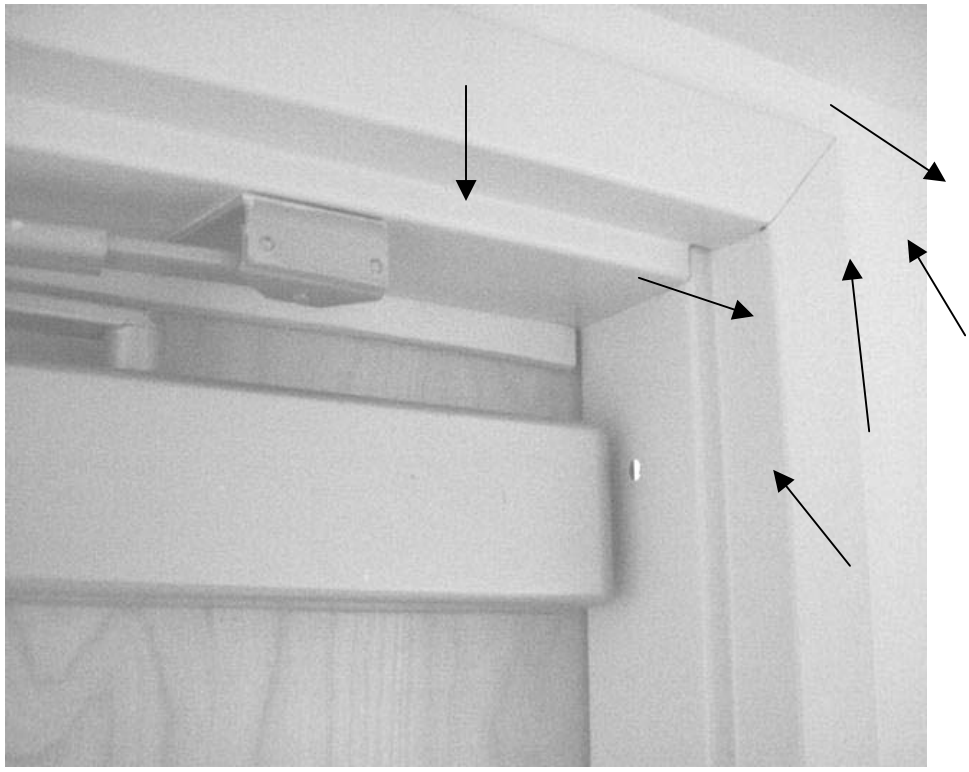
MGL. 1983. Hazardous Substances Disclosure by Employers. Massachusetts General Laws. M.G.L. c. 111F.

SMACNA. 1995. IAQ Guidelines for Occupied Buildings Under Construction. 1st ed. Sheet Metal and Air Conditioning Contractors' National Association, Inc., Chantilly, VA.

Figure 1 **Schematic of Pathway of Airflow from Culvert into the Elevator Shaft through Floor Layers**

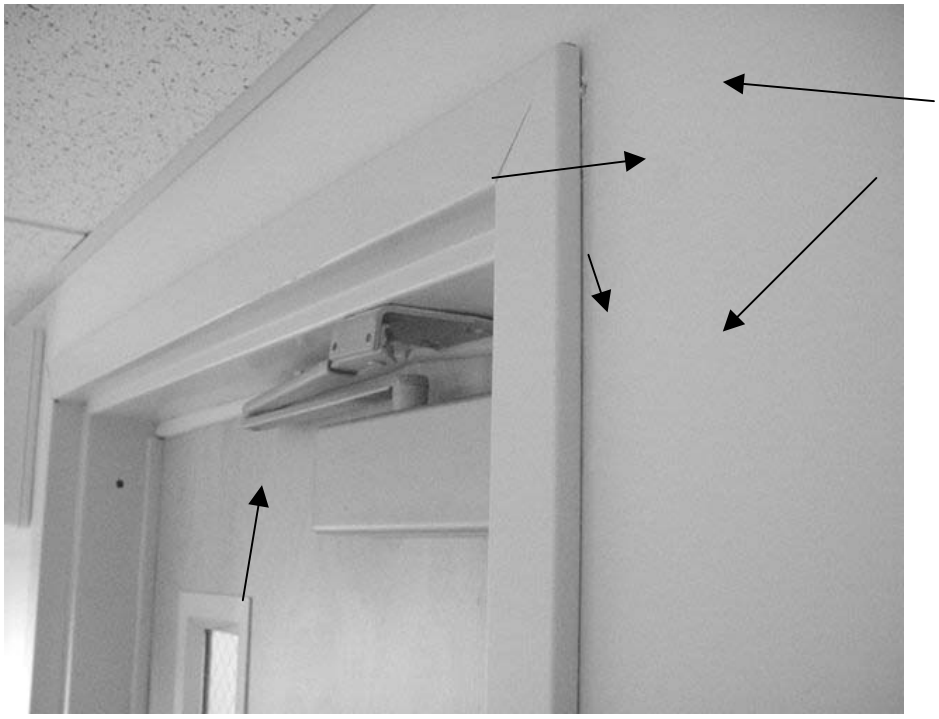


Picture 1



Arrows Indicate Seams That Need Be Rendered Airtight

Picture 2



Arrows Indicate Doorframe/Wallboard Joints and Doorframe Seams That Need Be Rendered Airtight

Picture 3

Pressure Relief Vent beneath Loading Dock of 17 Pleasant Street, Malden, MA

Picture 4

Stairwell Support Pillar Penetrating Flooring of Old Barbershop